We claim:

1. A method for making a nanocrystalline micellar solution, comprising:

   making a first solution comprising a hydrophobic material in an organic solvent;

   making a second solution comprising a surfactant in a liquid selected from water and an alcohol;

   mixing said first solution with said second solution to form a third solution; and

   removing at least a portion of said organic solvent to form a nanocrystalline micellar solution.

2. The method of claim 1 wherein the third solution is deposited on a substrate, selected from a transmission electron microscopy grid, silicon, glass, mica, and graphite prior to the step of removing at least a portion of said organic solvent.

3. The method of claim 1 wherein the hydrophobic material is selected from a metal, a semiconductor, a magnetic nanocrystal, a porphyrin, a dye molecule, carbon nanotubes, a fullerene, an oligomer, a dendrimer and a hydrophobic polymer.

4. The method of claim 1 wherein the hydrophobic material is selected from gold, silver, CdSe, CdTe, HgTe, CdHeTe, CdS, PdS, ZnS, ZnSe, CdSe/ZnS, InAs, InP, GaP, GaN, ZnO, Ge, Co, Ni, Fe, Cu, Si, Pt, Pd, PtPd, FePt, and $BaTiO_3$, carbon 60 compounds, carbon 70 compounds, carbon 80 compounds, and carbon 90 compounds.

5. The method of claim 1 wherein the surfactant is selected from a cationic surfactant, an anionic surfactant, a nonionic surfactant, a block polymer, and a lipid.

6. The method of claim 1 wherein the surfactant is selected from the group consisting of sulfates, sulfonates, phosphates, carboxylic acids, cetyltrimethylammonium bromide, alkylammonium salts, gemini surfactants, cetylethylpiperidinium salts, dialkyldimethylammonium, primary amines, poly(oxyethylene) oxides, octaethylene glycol monodecyl ether, octaethylene glycol monohexadecyl ether and block copolymers.

7. The method of claim 1 wherein the organic solvent is selected from chloroform, hexane, benzene, and toluene.
8. The method of claim 1 wherein the step of removing at least a portion of said organic solvent is performed using a technique selected from heating, evaporation and a vacuum process.
9. The method of claim 1 further comprising the step of adding a precursor co-assembling material to said nanocrystalline micellar solution.
10. The method of claim 9 wherein said precursor co-assembling material is selected from a metal oxide, a water-soluble oligomer and a water-soluble polymer.
11. The method of claim 10 wherein said metal oxide is selected from an alkoxysilane, titanium butoxide, titanium iso-propoxide, zirconium n-butoxide, and aluminum iso-propoxide.
12. The method of claim 11 wherein said alkoxysilane is selected from tetraethylorthosilicate and tetramethylorthosilicate.
13. The method of claim 9 wherein said precursor co-assembling material is selected from a water-soluble aniline oligomer, a water-soluble thiophene oligomer, a water-soluble polyaniline polymer and a water-soluble polythiolphene polymer.
14. The method of claim 9 wherein said step of adding a precursor co-assembling material to said nanocrystalline micellar solution is performed in the presence of an acid to form a mesophase nanocrystalline array solution.
15. The method of claim 14 wherein said mesophase nanocrystalline array solution is deposited as a thin film on a substrate.
16. The method of claim 15 wherein said substrate is selected from silicon, glass, mica, graphite and a transmission electron microscopy grid.
17. The method of claim 9 wherein said step of adding a precursor co-assembling material to said nanocrystalline micellar solution is performed in the presence of a base to precipitate a three-dimensional, mesophase nanocrystalline array in bulk form.

18. The method of claim 1 wherein the nanocrystalline micellar solution contains micelles, wherein each micelle contains at least one nanocrystalline hydrophobic precursor compound.

19. The method of claim 1 wherein the nanocrystalline micellar solution is prepared is less than 10 minutes.

20. The method of claim 1 wherein the nanocrystalline micellar solution is prepared at room temperature.

21. A method of preparing a metal-oxide-semiconductor, comprising:

making a first solution comprising gold in an organic solvent;

making a second solution comprising a surfactant in a liquid selected from water and an alcohol;

mixing said first solution with said second solution to form a third solution;

removing at least a portion of said organic solvent to form a nanocrystalline micellar solution;

adding an alkoxysilane to said nonocrystalline micellar solution in the presence of an acid to form a mesophase gold nanocrystalline/silica array solution;

preparing a silicon p-type substrate;

depositing backside contacts on said substrate;

depositing said mesophase gold nanocrystalline/silica array solution as a thin film on said substrate; and

forming a capacitor structure on said substrate.